

TITLE

"APPARATUS AND METHOD FOR CARRYING OUT A CONTINUED UNION OF PAPER WEBS"

SPECIFICATION

5 The present invention refers to an apparatus and a method for continually joining paper webs.

An apparatus usually employed for a continuous union of paper webs comprises, with reference to the outline of Fig. 1, two pairs of rollers and cylinders (A, B; C, D) for embossing paper webs (E, F), a roller (G) for distributing a given amount of glue onto the paper which transits in correspondence of one of the embossing rollers, and an impression roller with rubber-coated surface (H) positioned diametrically opposite to the gluing roller (G): the paper webs (E, F) result embossed as they transit between the surfaces of the corresponding embossing rollers and cylinders, that is, as they pass through the regions indicated by "X" and "Y" in Fig. 1, and become definitively glued by their passing onto the embossing roller (B) and because of the pressure exerted thereon by the rubber-coated roller (H). In Fig. 1, the arrows (VE, VF, VA) indicate the directions of advancement of web (E), web (F) and of the exiting coupled webs (AC).

One drawback relating to this operating technique lies in the fact that, because of the very compliance of the material that sheathes the output pressure roller (H), and of the pressure that this roller exerts on the first embossing cylinder (B), the material of the pressure roller penetrates the surface cavities of the cylinder. As a consequence, a mutual squashing of the two paper webs occurs throughout the space within which the coating material of the pressure roller fits into the cavities of the embossing cylinder (as

shown in Fig. 2A) and, accordingly, a kind of re-embossing is produced with a noticeable roughness on one of the two sides of the output material (see Fig. 2B, wherein "L" indicates the deformations in the coupled webs with respect to the ideal profile). Another drawback related to the use of this type of apparatus lies in the fact that the glue distribution's system brings about significant expenses due to the cost of the mechanical members and of the adhesive, and to the difficulty in keeping the system clean.

10 Another device commonly used for continually joining paper webs comprises a group - downstream of the embossing rollers and cylinders according to the outline of Fig. 3A - consisting of a smooth roller having a hard surface (Z) and a set of small rollers with surface reliefs (W) so disposed

15 that the outputting coupled webs will pass, by resting on the smooth roller (Z), under the small rollers (W). In this way, the reliefs of the small rollers will cause the mutual squashing of the two paper webs and, thereby, their union, without using any adhesive whatsoever.

20 One drawback related to such a device lies in that, in correspondence of the regions interested by the action of the small rollers, the embossing previously produced is lost and, on the coupled webs exiting from the device, two or more areas developed therealong result markedly visible (as

25 illustrated in Fig. 4 where "AC" indicates the coupled webs, "AM" indicate the above said areas, and an array of dots indicates the embossing operated upstream of the group and including the small rollers). In conclusion, also this known operating technique implies a partial but anyway evident lost

30 of the effects derived by the embossing of the two webs which make up the coupled webs. A further drawbacks related to the use of this type of device is that the small rollers tend to

vibrate when a given operating speed of the system has been exceeded and, thus, they tend to wear out prematurely, so that an upper limit is to be provided on the operable speed which results incompatible with the current production requirements. The said marks (AM) do not result, more often than not, perfectly centered with respect to the rolls formed when cutting the log of the coupled webs, which contributes to make the same marks (AM) still more unappealing.

The main object of the present invention is to overcome the above said drawbacks.

This result has been achieved, according to the invention, by providing an operating process and an apparatus having the characteristics indicated in the independent claims. Further characteristics being set forth in the dependent claims.

The present invention makes it possible to carry out a continued union of two paper webs, with or without a previous embossing and with or without the use of glue, without producing undesired surface deformations of the coupled webs which, therefore, result of a better quality. Besides, an apparatus according to the invention is easy to make, cost-effective and reliable even after a prolonged service life.

These and other advantages and characteristics of the invention will be best understood by anyone skilled in the art from a reading of the following description in conjunction with the attached drawings given as a practical exemplification of the invention, but not to be considered in a limitative sense, wherein:

- Fig. 1 is a simplified functional diagram of a known device;
- Figs. 2A and 2B show two enlarged details of Fig. 1 relating to means for the stabilization of the coupled webs;

- Fig. 3A is a diagram similar to that of Fig. 1 but relating of another known device;
 - Figs. 3B and 3C show two enlarged details of Fig. 3A;
 - Fig. 4 is a schematic plan view of the coupled webs on
5 output from the device of Fig. 3A;
 - Fig. 5A is a diagram similar to that of Figs. 1 and 3A but relating to an apparatus according to the present invention;
 - Figs. 5B and 5C two enlarged details of Fig. 5A;
 - Figs. 6A-6D show in front view different embodiments of a
10 stabilizing cylinder for the apparatus according to the invention;
 - Fig. 7 is a schematic view in diametrical section of the roller (2);
 - Fig. 8 is a diagram relating to another possible use of an
15 apparatus according to the present invention;
 - Fig. 9 is a diagram relating to a further possible use of an apparatus according to the present invention;
 - Fig. 10A is a diagram relating to yet another possible use of an apparatus according to the present invention;
 - Fig. 10B is a schematic, partial plan view of the product
20 on output from the system of Fig. 10A;
 - Fig. 11A is a schematic plan view of an impression roller or cylinder to be used in association with an apparatus according to the invention;
 - Fig. 11B is a section view taken on line M-M in Fig. 11A;
 - Fig. 12A is a schematic plan view of a further impression roller or cylinder to be used in association with an apparatus according to the invention;
 - Fig. 12B is a section view taken on line N-N in Fig. 12A.
- 30 Reduced to its basic structure, and reference being made to figures 5A-7 of the attached drawings, an apparatus according to the invention can be used in association with means for

the embossing of the coupled webs (1) and is made up of a roller (2) having an outer surface (20) applied upon an elastic support surface: the said roller (2) being engaged, free of rotating about its longitudinal axis, with a supporting fixed structure (not shown in the figures of the attached drawings for the sake of simplicity).

According to the example diagrammatically shown in Fig. 5A, the said embossing means comprise an operating group, of a type known to those skilled in the art, having two pairs of embossing rollers and cylinders (3, 4; 30, 40) associated with a corresponding motor member (not shown) to drive them into rotation about respective longitudinal axes, as indicated by the arrows (R) in Fig. 5A.

According to the example illustrated in Fig. 7, the said roller (2) comprises a rigid cylinder (21), made of steel for example, with coaxial end hubs (22) which define a shaft to be idly supported by a fixed structure (not shown). Said cylinder (21) is provided with an elastic coating (23), for example of "Neoprene" rubber having a hardness ranging from 60 to 90 Shore. Applied on said coating (23), for example by a "Loctite" adhesive, is a hard surface (20) made of steel, for example.

Said hard surface (20) can be formed, for example, by applying a helicoidal element having preset pitch and direction, as shown in Figs. 6A-6D. In case of the example of Fig. 6D, the screw pitch is preset so that the hard surface (20) will fully cover the elastic surface (23).

In practice, the surface (23) acts as an elastic support for the surface (20) which is laid on it.

The roller (2) is positioned downstream of the embossing means, so that the coupled webs (1) result, before leaving

the system, interposed between the embossing cylinder (4) and the roller (2).

The roller (2) is associated with hydraulic means, of a type known to those skilled in the art, which keep the same roller
5 all the time in abutment against the cylinder (4).

The cylinder (4) and roller (2) cooperate with each other in compressing the two webs (5, 6) which form the coupled webs (1). More particularly, the two webs are squashed, while advancing towards the outlet, between the surface of cylinder
10 (4) and the hard surface (20) of roll (2), thereby giving rise to a coupling of the webs which is sufficiently stable for the uses this type of material is intended for, even if no adhesive is employed between the two paper webs. The hardness of the surface (20) of roller (2) ensures that, in
15 the above said final coupling of the two webs, the same surface will not deform to such an extent that could make it penetrate the cavities or impressions of cylinder (4), so that the embossing previously operated will not undergo any undesired alteration. Besides, as the said surface (20) is
20 mounted on an elastic support, any vibration possibly derived by the cooperation between the rotating cylinder (4) and roller (2) is substantially suppressed.

When it is desired that the above described effect will interest the whole width of the coupling, the length of
25 roller (2) is made substantially equal to that of cylinder (4). If such effect has to concern only a portion of the coupling, the roller (2) can be shorter than the cylinder (4).

It will be appreciated that the said webs (5, 6) may be
30 either of individual or multiple type.

The above described apparatus (2) is advantageously utilizable also within a system of a type shown in Fig. 8,

according to which there is provided the union of an embossed web (5) with a smooth or non-embossed web (6) by means of a unique embossing group (3, 4) which operates the embossing of only one of the two webs. The operation of the apparatus (2) is identical to that previously described with reference to the schematic diagram of Fig. 5A.

The present apparatus is also advantageously utilizable also within a system of a type shown in Fig. 9, according to which there is provided the union of two webs (5, 6) which are both embossed by a unique embossing group (3, 4). Also in this case, the operation of the apparatus (2) is identical to that described with reference to the schematic diagram of Fig. 5A. Moreover, the present apparatus is also advantageously utilizable also within a system of a type shown in Fig. 10A, wherein no embossing is provided prior to the union of the paper webs. The cylinder (4) may be of a type provided either with simple pyramidal surface cuts, as illustrated in Fig. 10A, or with surface reliefs of a preset shape and design (401) and distributed over the surface of the same cylinder according to a predetermined order, as illustrated in Fig. 12A. In the latter case, the roller (2) may be advantageously of a type like the one represented in Fig. 6D, with the hard surface (20) fully covering the elastic surface (23). Also in this case, the operation of the apparatus (2) is identical to that described with reference to the schematic diagram of Fig. 5A.

The cylinder (4) represented in Fig. 11A may be advantageously used within the scheme of Fig. 5A. Such cylinder exhibits pyramidal surface cuts (400) - shown in the drawing with a grid-like filling - and reliefs (401) of predetermined shape and size.

In view of the union of the two paper webs (5, 6) which, as previously set forth, may be multiple webs, an operating method according to the present invention includes compressing the paper webs between a pressure roller or
5 cylinder (2) and an impression roller or cylinder (4), the said impression cylinder being provided with surface reliefs and/or depressions, and the outer surface of said pressure cylinder being a hard surface.

According to the method of the present invention, the said
10 cylinder (4) may also be an embossing cylinder.

The construction details may vary in any equivalent way as far as the shape, dimensions, elements disposition, nature of the used materials are concerned, without nevertheless departing from the scope of the adopted solution idea and,
15 thereby, remaining within the limits of the protection granted to the present patent.